

WHAT IS CLAIMED IS:

1. An adhesive protein comprising an amino acid sequence shown in SEQ ID NO: 6.

2. The adhesive protein of Claim 1, wherein the adhesive protein further
5 comprises a peptide for improving a physicochemical property of the adhesive protein which is attached to a carboxy- and/or amino-termini of the protein.

3. The adhesive protein of Claim 2, wherein the physicochemical property is selected from the group consisting of solubility, adhesion force, cross-linking, and improvement in protein expression, purification, and recovery rate.

10 4. The adhesive protein of Claim 2, wherein the peptide is derived from an adhesive protein.

5. The adhesive protein of Claim 4, wherein the adhesive protein is derived from a mussel adhesive protein.

6. The adhesive protein of Claim 2, wherein the peptide is an amino acid
15 sequence as shown in SEQ ID NO: 25 tandemly repeated 1 to 10 times.

7. The adhesive protein of Claim 6, wherein the adhesive protein comprises an amino acid sequence selected from the group consisting of an amino acid sequence as shown in SEQ ID NO: 10, an amino acid sequence as shown in SEQ ID NO: 12, and an amino acid sequence as shown in SEQ ID NO: 14.

20 8. The adhesive protein of Claim 2, wherein the peptide comprises 6 histidine residues.

9. The adhesive protein of Claim 8, wherein the adhesive protein comprises an

amino acid sequence selected from the group consisting of an amino acid sequence as shown in SEQ ID NO: 16, an amino acid sequence as shown in SEQ ID NO: 18, an amino acid sequence as shown in SEQ ID NO: 20, and an amino acid sequence as shown in SEQ ID NO: 22.

- 5 10. A polynucleotide comprising a nucleotide sequence encoding an adhesive protein according to Claim 1.

11. The polynucleotide of Claim 10, wherein the nucleotide sequence encoding the adhesive protein comprises a nucleotide sequence as shown in SEQ ID NO: 5.

- 10 12. A polynucleotide comprising a nucleotide sequence encoding the adhesive protein according to Claim 2 wherein a peptide for improving a physicochemical property of the adhesive protein is attached to a carboxy- and/or amino-termini of the adhesive protein consisting of an amino acid sequence as shown in SEQ ID NO: 6.

- 15 13. The polynucleotide of Claim 12, wherein the peptide is an amino acid sequence as shown in SEQ ID NO: 25 tandemly repeated 1 to 10 times.

14. The polynucleotide of Claim 13, wherein a nucleotide sequence encoding the peptide is selected from the group consisting of nucleotide sequences shown in SEQ ID Nos: 26 to 31 tandemly repeated 1 to 10 times.

- 20 15. The polynucleotide of Claim 13, wherein the polynucleotide is selected from the group consisting of a nucleotide sequence as shown in SEQ ID NO: 9, a nucleotide sequence as shown in SEQ ID NO: 11, and a nucleotide sequence as shown in SEQ ID NO: 13.

16. A polynucleotide comprising a nucleotide sequence encoding the adhesive protein according to Claim 8.

17. The polynucleotide of Claim 16, wherein the nucleotide sequence encoding the adhesive protein is selected from the group consisting of a nucleotide sequence as shown in SEQ ID NO: 15, a nucleotide sequence as shown in SEQ ID NO: 17, a nucleotide sequence as shown in SEQ ID NO: 19, and a nucleotide sequence as shown in SEQ ID NO: 21.

18. A vector that comprises operably a nucleotide sequence encoding an adhesive protein according to any one of Claims 1 to 9.

19. The vector of Claim 18, wherein the nucleotide sequence encoding the adhesive protein is selected from the group consisting of a nucleotide sequence as shown in SEQ ID NO: 5, a nucleotide sequence as shown in SEQ ID NO: 9, a nucleotide sequence as shown in SEQ ID NO: 11, a nucleotide sequence as shown in SEQ ID NO: 13, a nucleotide sequence as shown in SEQ ID NO: 15, a nucleotide sequence as shown in SEQ ID NO: 17, a nucleotide sequence as shown in SEQ ID NO: 19, and a nucleotide sequence as shown in SEQ ID NO: 21.

20. The vector of Claim 18, wherein the vector is pMDG05 (KCTC 10291BP) or pENG151(KCTC 10766BP).

21. A transformant transformed with the vector according to Claim 18, wherein the transformant is selected from the group consisting of prokaryotes, eukaryotes, and eukaryote-derived cells.

22. The transformant of Claim 21, wherein the prokaryote is *E. coli* or *Bacillus*

sp.

23. The transformant of Claim 21, wherein the eukaryote is selected from the group consisting of yeast, insects, plants, and animals.

24. The transformant of Claim 21, wherein the eukaryote-derived cells are
5 selected from the group consisting of plant cells, insect cells, and mammalian cells.

25. A method of producing an adhesive protein comprising the steps of:

- (a) constructing a vector that comprises operably a nucleotide encoding the adhesive protein according to Claim 1;
- (b) constructing a transformant by transforming the vector into a host cell; and
- 10 (c) producing recombinant adhesive protein by culturing the transformant.

26. The method of Claim 25, wherein the adhesive protein further comprises a peptide for improving a physicochemical property of the adhesive protein attached to a carboxy- and/or amino-termini of the protein.

27. The method of Claim 26, wherein the physicochemical property is selected
15 from the group consisting of solubility, adhesion force, cross-linking, and improvement in protein expression, purification, and recovery rate.

28. The method of Claim 26, wherein the peptide is derived from an adhesive protein.

29. The method of Claim 28, wherein the adhesive protein is derived from a
20 mussel adhesive protein.

30. The method of Claim 26, wherein the peptide is an amino acid sequence as shown in SEQ ID NO: 25 tandemly repeated 1 to 10 times.

31. The method of Claim 30, wherein the adhesive protein comprises an amino acid sequence selected from the group consisting of an amino acid sequence as shown in SEQ ID NO: 10, an amino acid sequence as shown in SEQ ID NO: 12, and an amino acid sequence as shown in SEQ ID NO: 14.

5 32. The method of Claim 26, wherein the peptide consists of 6 histidine residues.

33. The method of Claim 32, wherein the adhesive protein comprises an amino acid sequence selected from the group consisting of an amino acid sequence as shown in SEQ ID NO: 16, an amino acid sequence as shown in SEQ ID NO: 18, an amino acid
10 sequence as shown in SEQ ID NO: 20, and an amino acid sequence as shown in SEQ ID NO: 22.

34. A method of purifying adhesive protein comprising the steps of:

(a) lysing the transformant according to Claim 21, and then centrifuging it to isolate each of the supernatant and pellet;
15 (b) making a suspension by adding acidic organic solvent to the pellet and suspending it; and

(c) centrifuging the suspension to isolate the supernatant.

35. The method of Claim 34, wherein the acidic organic solvent has a pH of 3 to 6.

20 36. The method of Claim 34, wherein the acidic organic solvent is one or more selected from the group consisting of acetic acid, citric acid, and lactic acid.

37. The method of Claim 36, wherein the acetic acid is a 5 to 30 (v/v) %

aqueous solution.

38. The method of Claim 34, wherein gel filtration chromatography is further carried out on the supernatant of step (c).

39. An adhesive comprising an adhesive protein according to any one of
5 Claims 1 to 9 as an active component.

40. The adhesive of Claim 39, wherein 5 % to 100 % of the total number of tyrosine residues in the adhesive protein is modified to 3,4-dihydroxyphenyl-L-alanine (DOPA)

41. The adhesive of Claim 39, wherein the adhesive adheres to a substrate
10 selected from the group consisting of plastic, glass, metal, eukaryotic cells, prokaryotic cells, and plant cell walls and lipids.

42. The adhesive of Claim 39, wherein the adhesive is applied to biological sample.

43. The adhesive of Claim 39, wherein the adhesive further comprises one or
15 more material selected from the group consisting of surfactant, oxidant, and filler.

44. The adhesive of Claim 43, wherein the surfactant is sodium dodecylsulfate or sodium dodecylbenzensulfonate.

45. The adhesive of Claim 43, wherein the oxidant is tyrosinase or H_2O_2 .

46. The adhesive of Claim 43, wherein the filler is selected from the group
20 consisting of collagen, hyaluronic acid, chondroitin sulfate, elastine, laminin, casein, hydroxyapatite, and albumin, fibronectin, and hyaluron.

47. The adhesive of Claim 39, wherein the adhesive is applied to substrates

used in an underwater environment.

48. A method of adjusting the adhesion force of the adhesive according to Claim 39, wherein the method comprises a step of treating with a substance selected from the group consisting of oxidant, filler, and surfactant, or a step of controlling the
- 5 concentration of the adhesive protein which is an active component of the adhesive.

49. A coating agent containing an adhesive protein according to any one of Claims 1 to 9 as an active component.